

## REMARKS

Claims 1, 2, 4 and 12-17 are currently pending. Claim 1 has been amended to indicate that the paper from the pulp made from the method has a higher strength, measured by burst index and tear index, than paper made from a pulp made by just a kraft pulping process. Support for this limitation is found in table 13(b) of the specification. Applicants respectfully submit that no new matter has been added.

The application currently stands rejected for various reasons. The Declaration of Inventorship has been objected to. Claim 1 has been objected to. Claims 1, 2, 4, 12-14 and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,851,351 (hereinafter "Baecker") in view of Yang, TAPPI J., Vol. 76, No. 7 (hereinafter "Yang"). Claims 15 and 17 stand rejected under 35 USC § 103(a) over Baecker in view of Yang and Akhtar, U.S. Patent No. 5,620,564 (hereinafter the "564 patent"). Applicants respectfully traverse these rejections for at least the following reasons.

### Objection to the Declaration of Inventorship

The declaration of the application has been indicated as being defective as not identifying the city and either the state or foreign country of each inventor. A supplemental application data sheet has been submitted concurrently with this response to correct this error.

### Objection to claim 1

Claim 1 has been objected to as containing the word "in" after the word comprising. This has been corrected by amendment.

### Rejections under 35 USC § 103(a) over Baecker in view of Yang

Claims 1, 2, 4, 12-14 and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Baecker in view of Yang. The Manual of Patent Examining Procedure ("MPEP") sets forth that:

"To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the

art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure." See MPEP § 2143.

Applicants respectfully submit that the Office Action has failed to set forth a *prima facie* case of obviousness as all the requirements for a *prima facie* case have not been met.

Claims 1, 2, 4 and 12-17 relate to the biokraft pulping methods of eucalyptus wood. Claim 1 of the present invention, as amended, reads as follows:

"A method for producing eucalyptus paper pulp for use in the making of paper, wherein the paper produced by the eucalyptus pulp made by the method has a higher strength, as measured by burst index and tear index, than paper produced from eucalyptus pulp not treated with *Phanerochaete chrysosporium*, the method comprising the steps of:

- a) inoculating eucalyptus wood chips with white rot fungus which is *Phanerochaete chrysosporium*
- b) fermenting the wood chips so as to cause a propagation of the fungus through the wood chips and allow the fungus to modify lignin; and
- c) pulping of the degraded wood chips by a known kraft process." (See claim 1.)

Claims 2, 4 and 12-17 depend directly or indirectly from claim 1 and therefore contain all of the limitations of claim 1. Claims 2, 4 and 12-17, therefore, all contain the limitation of a "method for producing eucalyptus paper pulp for use in the making of paper, wherein the paper produced by the eucalyptus pulp made by the method has a higher strength, as measured by burst index and tear index, than paper produced from eucalyptus pulp not treated with *Phanerochaete chrysosporium*"

**1. General knowledge of one skilled in the art does not provide a sufficient motivation to modify or combine the Baecker patent or the Yang reference.**

The Baecker patent is directed towards a method for the "microbial pretreatment of woodchips to be transported by ship" (see col. 2, lines 6-7, of the Baecker patent). The reference contains no disclosure of the use of eucalyptus wood or the kraft pulping process. While the reference does disclose that "any pretreatment occurring will effectively result in cost savings" (see col. 3, lines 4-5, of the Baecker patent), the reference does not disclose what effect the

pretreatment would have on the strength of paper produced by such pulp. In the declaration of Dr. Akhtar submitted July 22, 2005, Dr. Akhtar states that:

“While a certain amount is known about the interaction of lignin and cellulose in wood fibers, because of the extreme complexity of the relationships, and the variation in the enzymes produced by varieties of the white-rot fungi, it is not readily possible to predict from the action of a given fungus on a given type of wood whether or not the paper made from wood partially digested with such fungus will have desirable qualities or not. The selection of white-rot fungi for biopulping applications on the basis of selective lignin degradation may seem a rational one, but it has proven to be a poor predictor of the quality of the resultant paper. The exact relationship between the degradation of lignin, and the resulting desirable qualities of paper produced at the end of the pulping process, are not at all clear. Accordingly, given present standards of technology and the present understanding of the complex interaction of lignin and cellulose, it is only possible to determine empirically the quality of paper produced through a given biological pulping process and the amount of any energy savings achieved through such a process.” (See paragraph 9 of the July 22nd, 2005 Akhtar Declaration).

Dr. Akhtar further states that:

“..as the nature of the white rot fungus-lignin relationship is not predictable, the teaching of biopulping methods utilizing white rot fungus with non-eucalyptus wood, would not suggest to one skilled in the art that the same methods and fungus species would necessarily be useful in the biopulping of a different species of wood.” (See paragraph 11 of the July 22<sup>nd</sup>, 2005 Akhtar Declaration)

As the nature of the biopulping art is unpredictable as to the qualities of the paper produced using such process when different species of fungi and wood are used, and as the Baecker patent contains no teaching or suggestion of the use of eucalyptus wood or a kraft pulping process, Applicants respectfully submit that a person skilled in the art would not have sufficient motivation to modify the teachings of the Baecker patent to use eucalyptus wood and a kraft process to provide paper of superior strength as set forth in the claims of the present invention.

This is especially true given Applicants' own research. As set forth in the Second Akhtar Declaration, when the method of the presently claimed invention (as set forth in claim 1) was utilized with loblolly pine and aspen wood chips, no significant difference was found in the strength properties of the pulp produced from non-fungus treated chips, from chips treated with fungus. (See paragraphs 9 and 10 of the Second Akhtar declaration and Exhibits D and E.)

However, when eucalyptus wood was used, a significant difference was found in the strength properties between fungus and non-fungus treated chips. See Table 13 on pages 46 and 47 of the specification.

The teaching of biopulping methods utilizing white rot fungus with one species of wood, therefore, would not suggest to one skilled in the art that the same methods and fungus species would necessarily be useful in the biopulping of a different species of wood to provide paper having improved strength characteristics. It is only possible to determine empirically the quality of paper produced through a given biological pulping process and the amount of any energy savings achieved through such a process. (See paragraphs 9 and 11 of the July 22, 2005 Akhtar Declaration and paragraphs 9 and 10 of the Second Akhtar Declaration.)

The Yang reference is directed towards the bleaching of eucalyptus kraft pulp using an EnZone process (see summary of Yang). The Yang reference contains no teaching or suggestions of any biological treatment of wood chips prior to the kraft pulping of wood. The Examiner has stated that "it would have been obvious to the routineer to use the hard wood eucalyptus of Yang when making the Kraft pulp of Baecker." Applicants respectfully disagree with this assertion.

First, the Yang reference contains no disclosure or suggestion of any biopulping process. Additionally, the Baecker patent contains no teaching or suggestion of the use of eucalyptus wood (or any other specific species of wood) in a kraft pulping process. Given the unpredictable nature of the paper quality in biopulping procedures using different fungi species, wood species and pulping procedures as delineated above and discussed in paragraphs 9 and 11 of the Second Akhtar Declaration, one of ordinary skill in the art would not have the motivation to combine the teaching of the Yang reference and the Baecker patent to arrive at the method of claim 1 given the lack of teaching of the two references. Baecker does not suggest that any specific species of wood, when treated with *Phanerochaete chrysosporium*, could be the basis for paper having superior strength properties. Furthermore, based on the teachings of Baecker, one would think that all species of wood would be just as suitable for *Phanerochaete chrysosporium* pre-treatment, and would not be motivated to select any specific species. Applicants have shown that not all species are equally suitable for pre treatment with *Phanerochaete chrysosporium*.

Absent a specific suggestion in Baecker as to what wood species may be suitable, one of ordinary skill in the art would not be motivated to use eucalyptus over any other species of wood in the process of Baecker. Furthermore, while Yang teaches the use of eucalyptus wood in a bleaching process, it does not suggest the suitability of eucalyptus in providing paper of superior strength when used in a biokraft process. The Yang reference contains no teaching or suggestion that eucalyptus wood is particularly suited to *Phanerochaete chrysosporium* pretreatment, or that the treated wood chips of eucalyptus wood provide any special properties relating to the strength of paper made from such chips. One of skill in the art would have no reason as to why they should combine the teachings of the Yang reference with the Baecker reference. Applicants respectfully submit that one of ordinary skill in the art would not be motivated to modify, or combine, the cited references to provide the method as set forth in claim 1 for obtaining pulp that would produce paper having superior strength properties.

Second, even if one were to assume, solely for the purposes of argument, that the art provides motivation to combine the references, given the knowledge of one skilled in art, one would find that the prior art does not suggest a reasonable expectation of success. Baecker does not disclose any specific preference of wood species, and only teaches generally of treating wood. Given this, Baecker would seem to suggest to one of skill in the art that one wood species to be just as good as another in such a method. Applicants' own experiments, however, have shown that not all species of wood, when treated with *Phanerochaete chrysosporium*, provide pulp that makes paper with superior strength characteristics from non-treated wood of the same species. When Applicants attempted biokraft pulping with loblolly pine and aspen, the results showed no advantage of using fungus-treated chips over control chips (non-fungus-treated chips) in terms of paper quality. No significant difference was shown in the strength of such biokraft pulp paper over regular paper produced from standard kraft pulps of loblolly pine and aspen. (See Exhibits D and E of the Second Akhtar Declaration). Given such results, one would of ordinary skill in the art would be led to believe that using any other specific species of wood (besides loblolly pine and aspen) should provide the same results, and would not find a likelihood of success of obtaining pulp that provides for paper having superior strength properties in comparison to the same species of wood not treated with *Phanerochaete chrysosporium*. This is especially true in light of the fact that Baecker suggests no specific wood species. While Yang teaches the use of eucalyptus wood, this is in the context of a bleaching

process, and does not suggest anything regarding the suitability of eucalyptus for a *Phanerochaete chrysosporium* treatment followed by kraft pulping, or that such a process would provide paper having superior strength properties. Applicants respectfully submit that given Applicants' own experiments, one of ordinary skill in the would not find, given the general teachings of Baecker and Yang, that there would be a likelihood of success in obtaining pulp that provides for paper with superior strength properties by utilizing the methods as set forth in claim 1.

In view of the above, Applicants respectfully submit that a *prima facie* case of obviousness of claims 1, 2, 4 and 12-17, after amendment herein, has not been established. Therefore, Applicants respectfully request the withdrawal of the rejection of all the present pending claims under 35 USC § 103(a).

## **2. Surprising and Unexpected Results**

Applicants submit that even if a case of *prima facie* obviousness can be made, the unexpected results of the present invention rebut such a finding. Evidence of surprising and unexpected results can be sufficient to rebut a *prima facie* case of obviousness, under 35 U.S.C. § 103(a). The Manual of Patent Examining Procedures states that:

"Greater than expected results are evidence of nonobviousness. 'A greater than expected result is an evidentiary factor pertinent to the legal conclusion of obviousness ... of the claims at issue.' In re Corkill, 711 F.2d 1496, 226 USPQ 1005 (Fed. Cir. 1985)." MPEP § 716.02(a).

Applicants respectfully submit that surprising and unexpected results are established by evidence presented in the specification, as well as by additional evidence of the surprising and unexpected nature of the results presented in the Second Akhtar Declaration. Applicants submit that the specification of the present application contains results from well-controlled experiments which clearly demonstrate that paper produced according to the methods of the present invention has properties which would have been surprising and unexpected to one of ordinary skill in the art at the time the invention was made. Specifically, paper produced by the pulp made according to the methods of the present invention possesses strength better than that of paper produced from regularly kraft pulped eucalyptus wood.

As has been delineated above, the results of biopulping techniques on different species of wood, using different species of fungi, is of an unpredictable nature. As Dr. Akhtar stated in his Declaration:

“Given present standards of technology in the present understanding of the complex interaction of lignin and cellulose, it is only possible to determine empirically the quality of paper produced through a given biological pulping process and the amount of energy savings achieved through such a process.” (See paragraph 9 of the July 22, 2005 Akhtar Declaration).

None of the cited prior art references contain any empirical teaching as to the use of eucalyptus wood in a biokraft process to make a paper pulp. Additionally, if it would have been obvious from the cited references to use a kraft pulping process with a biopulping procedure to obtain paper of superior strength from any wood, one would expect that the biokraft pulping procedure of the present invention would produce superior strength paper using loblolly pine and aspen. However, as discussed in the Second Akhtar Declaration, Applicants have shown that such a biokraft pulping procedure does not lead to differences in paper quality when loblolly pine and aspen are used. The Second Akhtar Declaration discloses that:

“Using similar methods of the present invention, I performed a biokraft pulping process on loblolly pine chips. The chips were then treated with *Phanerochaete chrysosporium* and incubated for two weeks. The preparation conditions were the same, apart from the active alkali content, from the conditions used in the treatment of eucalyptus wood as set forth in table 13 of the present specification (see pp. 46-47). The effectiveness of fungal pretreatment was evaluated based on yield and physical properties of the resulting paper after cooking. The physical properties of pulps were measured following the TAPPI standard methods. Results on pulp yield and the physical properties of the paper made with and without fungal pretreatments are shown in Table 13 (See Exhibit D). In each experiment set up I tried to compare the advantage of using fungus-treated chips over the non-treated control chips in kraft pulping processes. The preliminary results showed no apparent advantage of using fungus-treated chips over the control chips in terms of pulp yield and physical properties. I found no significant difference in the properties of the pulp produced from control chips and fungus-treated chips cooked under identical conditions.

Using similar methods of the present invention, I performed a biokraft pulping process on aspen wood chips. The chips were then treated with *Phanerochaete chrysosporium* and incubated for two weeks. The preparation conditions were the same, apart from the active alkali content, from the conditions used in the treatment of eucalyptus wood as set forth in table 13 of the present specification

(see pp. 46-47). The effectiveness of fungal pretreatment was evaluated based on yield and physical properties of the resulting paper after cooking. The physical properties of pulps were measured following the TAPPI standard methods. Results on pulp yield and the physical properties of the paper made with and without fungal pretreatments are shown in Table 13 (see Exhibit E). In each experiment set up I tried to compare the advantage of using fungus-treated chips over the non-treated control chips in kraft pulping processes. The preliminary results showed no apparent advantage of using fungus-treated chips over the control chips in terms of pulp yield and physical properties. I found no significant difference in the properties of the pulp produced from control chips and fungus-treated chips cooked under identical conditions.” (See paragraphs 9-10 of the Second Akhtar Declaration.)

Given this disclosure, one skilled in the art would assume that a biokraft pulping procedure would not produce paper of any significant difference strength properties than paper made from standard kraft pulping procedures. Applicants, however, found surprisingly unexpected results when using their biokraft procedure with eucalyptus wood in that the paper produced from such a method has better strength characteristics than that of paper produced using a simple kraft pulping procedure. The Second Akhtar Declaration sets forth that:

“Based on the biokraft pulping experiments on loblolly pine and aspen, it was expected that the biokraft pulping of eucalyptus would produce similar results (i.e., no significant difference between the properties of the pulp produced from the control chips and the fungus-treated chips) however, when the method of the present invention is utilized with eucalyptus wood chips, unexpected results are achieved. The biokraft pulping method used with eucalyptus wood results in improved chemical pulping efficiency and pulp properties (brightness and strength). An experiment as set forth in Example 1 of the specification was performed using the white rot fungus species *Phanerochaete chrysosporium* (see pp. 13-15 of the specification.) A biokraft eucalyptus pulp is compared to that of a control which was not treated by *Phanerochaete chrysosporium*. The unbleached brightness and the final brightness of the biokraft eucalyptus pulp are higher than that of the control pulp (see Table 13(a) on page 46). Additionally, the strength properties of the treated eucalyptus chips are greatly improved (see Table 13(b) on page 47 of the Specification). Furthermore, the beating time of the kraft process utilizing biotreated eucalyptus wood is reduced by 33%. Such remarkable results have not been cited or suggested in the prior art with any other wood species tested.” (See paragraph 11 of the Second Akhtar Declaration.)

For reasons set forth hereinabove, therefore, Applicants respectfully submit that the methods of the present invention would not have been obvious to one of ordinary skill in the art at the time the invention was made. Specifically, the presently-claimed methods produce results



which would have been surprising and unexpected to one of ordinary skill in the art at the time the invention was made, or even at the time the present application was filed. In view of the above, therefore, Applicants respectfully request the withdrawal of the rejection of claims 1, 2, 4 and 12-17 under 35 U.S.C. § 103(a).

Rejections under 35 USC § 103(a) over Baecker in view of Yang in further view of the '564 Patent

Claims 15 and 17 stand rejected under 35 USC § 103(a) over Baecker in view of Yang in further view of the '564 patent. Applicants respectfully submit that the Office Action has failed to set forth a *prima facie* case of obviousness, as all the requirements for a *prima facie* case have not been met with respect to claims 15 and 17.

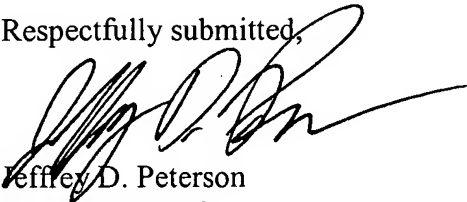
Claims 15 and 17 depend from claim 1, and therefore contain all of the limitations of claim 1. As discussed above, Applicants' experiments have demonstrated that not all species of wood, when used in the method of claim 1, provide pulp that produces paper having superior strength properties from non *Phanerochaete chrysosporium* treated wood of the same species. The Baecker references, as discussed above, fails to teach or suggest that eucalyptus wood, when treated with *Phanerochaete chrysosporium* and kraft pulped, would provide pulp that makes paper having superior strength properties from paper made from non-treated wood. Similarly, as discussed above, while Yang teaches the use of eucalyptus for bleaching, the application fails to teach or suggest that wood, when treated with *Phanerochaete chrysosporium* and kraft pulped, would provide pulp that makes paper having superior strength properties from paper made from non-treated wood. The '564 patent also fails to teach or suggest such a limitation. The '564 patent is directed at a method of biopulping loblolly pine and aspen. The '564 patent contains no teaching or suggestion of the use of eucalyptus wood. As shown by Applicants' experiments as set forth in Exhibits D and E of the Second Akhtar Declaration, *Phanerochaete chrysosporium* treated loblolly pine and aspen do not provide pulp that makes paper having superior strength properties from paper made from non-treated wood. Based on Applicants' experiments, and the lack of teaching of the '564 patent on the use of eucalyptus wood, one of ordinary skill in the art would not be motivated to use eucalyptus wood in the process taught by the '564 patent. Certainly one of ordinary skill in the art would not believe that

there was a likelihood of success in obtaining paper having superior strength properties contrasted with paper made from non-treated wood, given the results of Applicants' experiments. As the cited references, alone or in combination, fail to provide motivation for the use of eucalyptus with *Phanerochaete chrysosporium* and a kraft pulping procedure, fail to provide a likelihood of success in using such wood in such a procedure in obtaining pulp that makes paper having superior strength properties from non-treated wood, and fail to teach or suggest all of the limitations of the invention, namely a "method for producing eucalyptus paper pulp for use in the making of paper, wherein the paper produced by the eucalyptus pulp made by the method has a higher strength, as measured by burst index and tear index, than paper produced from eucalyptus pulp not treated with *Phanerochaete chrysosporium*, the method . . .", the references do not provide for a *prima facie* case of obviousness. Furthermore, Applicants submit that even if a case of *prima facie* obviousness can be made, the unexpected results of the present invention rebut such a finding as discussed above. Therefore, Applicants respectfully request the withdrawal of the rejection of claims 15 and 17 under 35 USC § 103(a).

#### SUMMARY

Based on the foregoing, Applicants respectfully submit that the present application is in condition for allowance, and a favorable action thereon is respectfully requested. Should the Examiner feel that any other point requires consideration or that the form of the claims can be improved, the Examiner is invited to contact the undersigned at the telephone number listed below.

Respectfully submitted,



Jeffrey D. Peterson  
Reg. No. 49,038

Docket No.: 016260-9005-US01  
Michael Best & Friedrich LLP  
One South Pinckney Street  
P. O. Box 1806  
Madison, WI 53701-1806  
608.257.3501  
Q:\client\016260\9005\B0758592.1